

# Does Class Size Matter?

## The Curious Case of the Large Lecture Hall



# INTRODUCTION

- Sample:  $n = 11,907$  Level 1 Microeconomics students who wrote the final exam
- Dependent Variable: Exam grades from 2006 – 2012.
- Average exam grade = 66.7%
- Explanatory Factors: class size, use of PPT, use of podcasts, in-class quiz assessment, on-line homework

# CLASS SIZE

- Fall 2006 – Summer 2007: class size average ~ 150 students; various classrooms used across campus
- Fall 2007 – Winter 2012: class size average ~ 570 students; classes held in MDCL 1305
- LARGE = 1 if large class (Fall 2007 - )  
0 otherwise

# USE OF POWERPOINT NOTES

- Fall 2006 – Winter 2007: students took own notes from lectures
- Summer 2007 – Winter 2012: students given complete PPT lecture notes
- $PPT = 1$  if PowerPoint slides used and provided to students  
0 otherwise

# USE OF PODCASTS

- Fall 2008: introduced pre-recorded podcasts of lectures
- Fall 2009: introduced podcasts of live lectures
- $\text{PODCAST} = 1$  if podcasts available  
0 otherwise

# IN-CLASS QUIZZES

- From Winter 2010 – Fall 2011 students were administered weekly quizzes to be written in the classroom
- Held as a 30 minute class test
- 10 multiple choice questions based on lecture material from the previous week
- Best 5 of 10 counted toward final grade
- Worth 5% of final grade
- QUIZ = 1 if in-class quizzes were held  
0 otherwise

# GROUP QUIZZES

- Winter 2012
- Same format as in-class quizzes
- Students worked in groups or alone
- No aids allowed
- $GPQUIZ = 1$  if students allowed to work together on in-class quizzes  
0 otherwise

# ONLINE HOMEWORK

- Summer 2007 – Fall 2008: students used Aplia software (purchased separately as a supplement to the textbook) to complete online homework assignments
- Best 6 of 11 counted for a total of 5% of the student's final grade
- Replaced in Winter 2009 for one term by online assignments written by instructor and available on course LMS
- $APLIA = 1$  if online homework assigned  
0 otherwise



# OTHER CONTROLS

- Interaction dummy variables to test whether there are any significant impacts from combinations of class size and certain classroom technologies
- LGPPT: if PowerPoint is used in a large class
- LGPOD: if podcasts are used in a large class
- PPTPOD: if PowerPoint and podcasts are used together
- TERM: when the class took place

# METHODOLOGY

- 1. Bivariate correlation analysis
  - Kendall's tau-b
- 2. Comparison of means
  - Independent samples t-test, ANOVA
- 3. Multiple linear regression

# FINDINGS

## 1. Bivariate Correlations

- No correlation coefficient between exam grade and factor exceeds  $|.06| \Rightarrow$  no substantial correlations
- Multicollinearity between QUIZ and APLIA, some between PPT and LARGE

- All correlations are positive correlations except:
- Quizzes and Group Quizzes are *negatively* correlated with Exam Grade
- Average Exam Grade tended to *decrease* over time. This corresponds to the change from smaller to larger classes and an increase in instructor workload (15 to 18 units each academic year)

- The only correlation not statistically significant at  $\alpha = .05$  is between Exam Grade and Large Class Size ( $p = .265$ )
- Large classes and exam grades are *not* correlated

## 2. Comparison of Average Exam Grades by Factor

- Average Exam Grade is found to be *higher* when podcasts, PowerPoint slides and online homework were part of course delivery (significant at  $\alpha = .011$ )
- Average Exam Grade is found to be *lower* when any type of in-class quiz was administered (significant at  $\alpha = .004$ )

- Average Exam Grade is found to be *higher* when both PowerPoint slides and podcasts are used together as part of course delivery
- An average of 67.1 compared to 64.7 (significant at  $\alpha = .000$ )

- Average Exam Grade is found to be *higher* for students taking the class during the Spring/Summer session compared to Fall and Winter students
- An average grade of 74.5 compared to 66.7 (significant at  $\alpha = .000$ )



- There is no statistically significant difference in average Exam Grade between Large or Smaller Classes ( $p = .265$ )

### 3. Multiple Linear Regression

- The explanatory variables chosen for the final model (after accounting for multicollinearity) are LARGE, PPT, PODCAST, QUIZ and GPQUIZ
- Dependent variable: EXAM GRADE

### SPSS Output Coefficients

Explanatory Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	65.063	.620		104.926	.000
LARGE	-10.308	1.836	-.150	-5.613	.000
PPT	9.398	1.899	.129	4.949	.000
PODCAST	4.751	.458	.117	10.381	.000
QUIZ	-2.688	.309	-.089	-8.708	.000
GROUPQUIZ	-.777	.499	-.014	-1.558	.119

Dependent Variable: EXAM GRADE

$R^2 = .013$

- Findings:
- Impact of large class size is a decrease in average Exam Grade of 10.3 percentage points, *ceteris paribus*
- p-value = .000

- Findings:
- Impact of access to complete PPT lecture slides/notes is an *increase* in average Exam Grade of 9.4 percentage points, *ceteris paribus*
- p-value = .000

- Findings:
- The use of podcasts is predicted to *increase* average Exam Grades by 4.8 percentage points, *ceteris paribus*
- p-value = .000

- Findings:
- Average Exam Grades are predicted to *decrease* by 2.7 percentage points when students individually write weekly quizzes, *ceteris paribus*
- p-value = .000

- Findings:
- Average Exam Grades are predicted to *decrease* by .8 percentage points when students work together to write weekly quizzes, *ceteris paribus*
- p-value = .119 not significant at  $\alpha = .05$



# OBSERVATIONS

- Other things being equal, large class size does not appear to negatively impact student outcomes as measured by their performance on the final exam.
- But, when different learning technologies are used (presumably techniques implemented to temper any negative impacts of large class size on students), class size *does* become an issue.

This begs the first question:

- Are our efforts to incorporate different learning tools and technologies inadvertently making things worse for students in large classes (particularly Level 1 students whose classes are typically larger than are upper level classes)?

- Or, conversely, is class size not an issue if we use “corrective” technologies such as podcasts and PowerPoint to counteract potential negative effects from large classes?

## Second question:

- No difference in student performance on the final exam is apparent whether students work together on quizzes or individually as is the traditional method of testing knowledge. Is there any value in encouraging student-directed learning (by encouraging them to work together to problem-solve) in large Level 1 classes?

Third question:

- Are “paper” tests/quizzes outdated methods of student evaluation if they negatively impact students’ exam grades or do students build a false confidence which leads them to study less or not try as hard on the final exam?